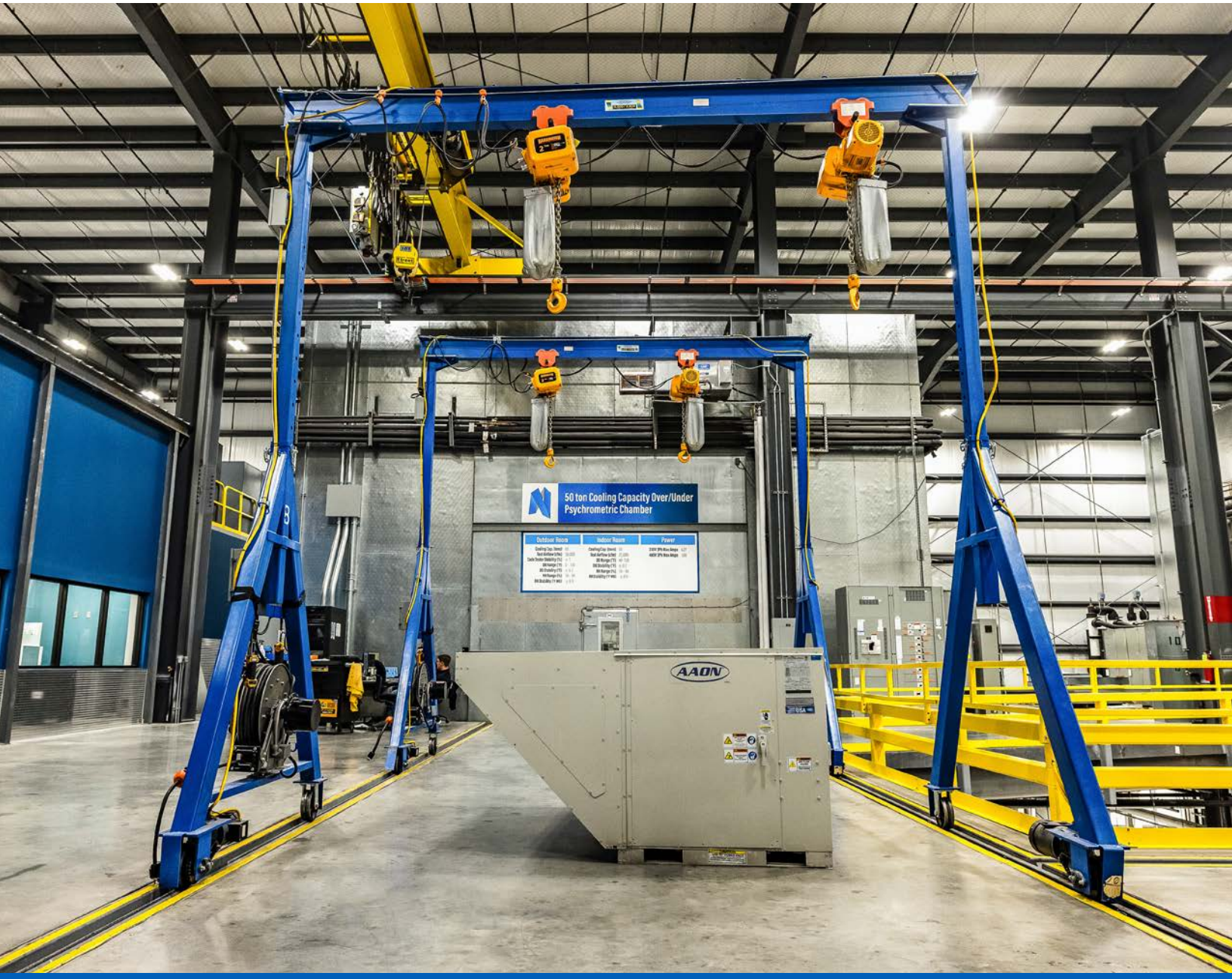
Norman Asbjornson Innovation Center



Advanced testing for innovative design.

The Norman Asbjornson Innovation Center (NAIC) is a research and development laboratory that solidifies AAON as the technological leader in high performance HVAC equipment.

The lab prioritizes two key areas of testing: product development testing and customer witness testing. This could include other manufacturers or non-HVAC companies to utilize a testing chamber for simulating different weather conditions. The lab is also capable of A2L testing. A2L testing utilizes a mildly flammable refrigerant, and special leak detecting sensors must be used that fall in accordance with standard UL-60335.

The NAIC is a 65 foot tall 134,000 square foot laboratory marvel that has 12 psychrometric chambers capable of measuring both acoustics and thermal performance. A few features of the lab include supply, return, and outside sound testing at actual load conditions, testing of up to a 300 ton air conditioning system, testing of up to a 540 ton chiller system, and 80 million Btu of gas heating test capacity. Environmental chamber testing capabilities include -20°F to 130°F testing conditions, up to 8 inches per hour rain testing, up to 2 inches per hour snow testing, and up to 50 mph wind testing.

The reverberation sound chamber is by far the greatest accomplishment for this lab. The chamber is isolated into three different sections for supply, return, and outside sound measurement. Furthermore, the testing chamber is able to measure the efficiency by which energy is converted into heating, cooling, or air movement. AAON currently holds the record for the largest psychrometric reverberation sound chamber in the world!

Product Development Testing

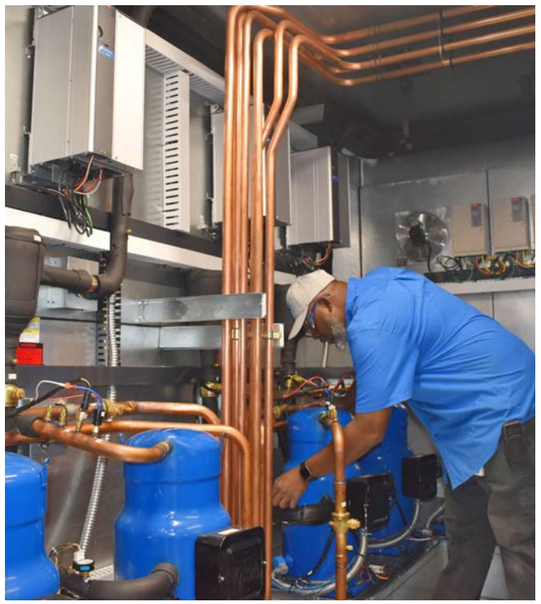
Two of the main focuses of the NAIC is current product development and new product development. These developments help to improve the growth of AAON technology and quality to continue moving forward in the HVAC industry.

CURRENT PRODUCT DEVELOPMENT

Current product development involves testing products that are currently sold but working to improve specific areas of performance such as different compressor combinations, controls staging applications, or coil performance modifications. Examples of these units are the Cold Climate Air-Source Heat Pumps and R-454b A2L testing.

NEW PRODUCT DEVELOPMENT

New product development takes the focus on creating a new unit design or any other large change that sets a unit apart from what is currently made. One example of these developments is the indoor agriculture grow facility units. These units involved a new change of controls sequences that were required specifically for the application. Another example is the testing of data center units from BASX.



Customer Witness Testing

The NAIC is not only a place for development testing, but also allowing the unique experience for customers to witness the testing of their units in the lab. The customer will have the ability to watch their units tested at the real-world conditions of their application or at AHRI/ASHRAE/ISO test standard conditions. The customer will have the capability of testing their unit in one of the calibrated testing chambers or perform testing in one of the bay areas on the floor of the lab. See firsthand the capabilities and performance of AAON equipment in the beautifully designed lab facilities of the NAIC.

BENEFITS OF LAB TESTING

Verify capacity and efficiency before equipment installation

Verify acoustic performance at actual application conditions

Eliminate risk of costly job site modifications

Verify startup and functionality performance

Types of Testing Offered

CHAMBER TESTING

With chamber testing, the customer will have the ability to watch their unit perform in simulated outdoor and indoor conditions, whether that is to simulate a 100% outdoor air unit, an AHRI conditions unit, or a special application with control features. While in the chamber, the customer can work with engineers on improvements, specifications, or direction on the application trying to be achieved.

FLOOR TESTING

Floor testing is a great option if testing a larger order of units versus just one unit application. This type of testing is mostly done for verifying startup of the unit, performance, and to inspect the unit for any issues before the units are sent to the job site. Any punch list items or issues discovered will require the unit to go back to production for rework.

Floor testing setup in the NAIC bay area

THIRD PARTY TESTING

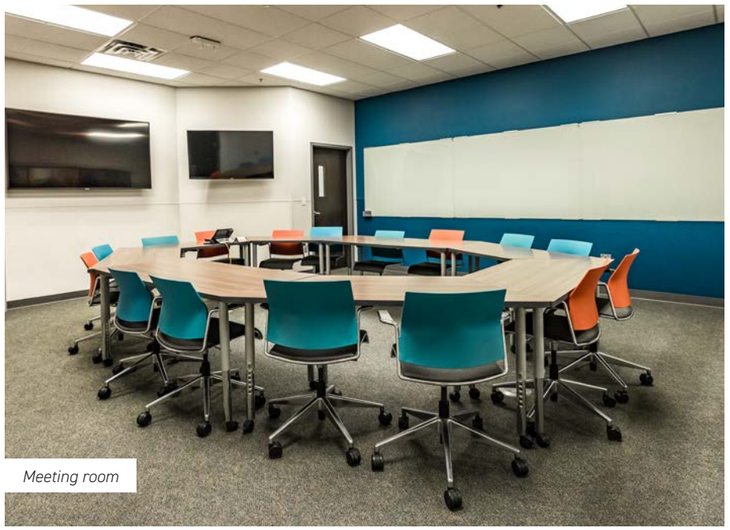
Although most customer testing in the lab is focused on AAON products, the lab is also open to allow for outside vendors to utilize the test chambers for their products. This could include other HVAC companies or non-HVAC related companies, such as vehicle or component manufacturers. The customer can rent one of the chambers to simulate different weather applications for their product.

MOCKUP ROOM

The mockup room consists of two offices and a maintenance room that is an exact replica, or mockup, of the offices in a New York building high-rise tower. This allows a customer the option to place their unit in the maintenance room and measure the sound that would be heard in the offices next door. This is a great way for testing a unit application for a building requiring low decibel levels.

AAON Engineer Accessibility and Collaboration

The NAIC offers two office spaces on the third floor where the testing engineers and development engineers collaborate. Since the units are tested in the upper chambers of the third floor, this allows customers to have quick access to the testing engineer or development engineer if questions or issues arise during testing. In between the offices is the main conference room where people can collaborate together, remote-in to a live stream of the testing chamber of their unit under test, and discuss progress of the project all within a comfortable environment.



Meeting room

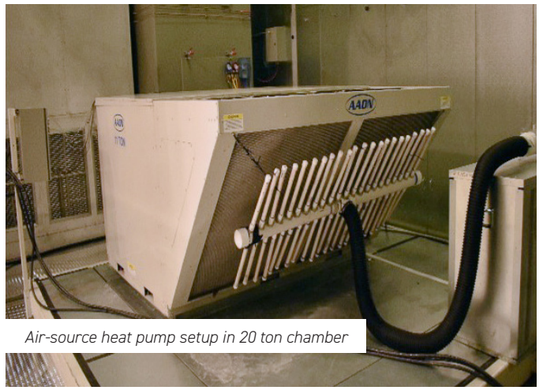
Office space mockup room

Mechanical room

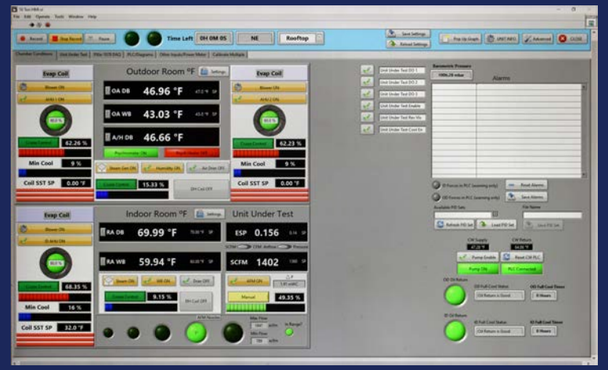
Test Chambers

The NAIC consists of 12 testing chambers allowing AAON to meet and maintain AHRI (Air-Conditioning Heating and Refrigeration Institute) and DOE (Department of Energy) certification, and solidifying the company's industry position as a technological leader in the manufacturing of HVAC equipment. These chambers are set up in an over/under configuration, having an outdoor room where the unit is installed to simulate the outdoor conditions, and an indoor room to simulate the building load on the unit. Unit configurations include packaged units and split-system units. These chambers allow testing for Air-Source Heat Pumps, Water-Source Heat Pumps, and Chillers.

The features of these chambers include refrigeration evaporator coils, hot water coils, electric heat strips, and humidity steam control. The chambers utilize a shell and tube heat exchanger condenser barrel instead of an air cooled coil. This means that chilled water is used to remove heat from the refrigerant instead of air. The 50 and 100 ton chambers are powered by screw compressors while the 20 ton chambers are powered by reciprocating compressors. The screw compressors are more resilient for the larger tonnage chambers and tend to be more efficient with the chamber loads.



Air-source heat pump setup in 20 ton chamber



The integrated custom software for the chambers allow the chamber operator the ability to control the amount of cooling, heating, and humidity to add to or remove from the chamber. It also allows for the ability to accurately control and simulate the drybulb and wetbulb conditions that are needed for the testing application. The software allows the operator to view the unit under test (UUT) pressures, temperatures, power, capacity, EER/COP, and other readings of the chamber. These readings are recorded every second. Each chamber is equipped with an airflow meter, also called a code tester, to measure the airspeed (SCFM) of the unit. This can be adjusted during operation to accurately set the desired airflow speed and static pressure required for the specific testing conditions.

Chamber testing in the lab follows in line with standards ISO 13256, AHRI 210/240, and AHRI 340/360. The tolerances for drybulb and wetbulb measurements per AAON standard is ± 0.3°F. This tighter tolerance ensures the most accurate data is recorded. When a test is completed, all the data is recorded automatically though the software in a summary spreadsheet containing valuable information such as the unit line pressures and temperatures, supply, return, and outside temperatures, capacity and efficiencies, and power. Recording and storing this data in these spreadsheets allows for quick navigation of unit performance results so that adjustments can be made to deliver the best unit performance.

Chamber Instrumentation

The instrumentation in the psychrometric chambers is capable of measuring temperature, humidity, pressures, airflow, water flow, fan speed, air velocity, voltage, current, frequency, power factor, power, and much more. Each chamber is equipped with psychrometers, which are used to accurately measure the drybulb and wetbulb temperatures of the supply air, return air, and the outdoor air temperature surrounding the unit. From these values, unit performance and other valuable information is collected.

A unit can also be fitted with an external flow meter that is connected in-line to the refrigerant liquid line. This allows data to be gathered for a second capacity check. The integrated data acquisition (DAQ) system in the chambers is capable of reading, processing, and saving over 93,000 points of data per minute. The chamber data combined with the data gathered from floor testing creates over 120,000 different data points in one minute of testing. There are about 200,000 calibrated sensors in total in the lab!

Psychrometer in each chamber

SAMPLE TEST REPORT DATA

KEY		
	ID = Indoor	DB = Drybulb
	OD = Outdoor	WB = Wetbulb

CAPACITY AND EFFICIENCY SUMMARY

	POINT	MIN	MAX	AVG
Total Capacity	167,648	165,085	169,974	167,326
Sensible Capacity	122,136	120,719	123,351	121,854
Latent Capacity	45,512	44,366	46,623	45,472
ID Total Air Flow-SCFM	5,017	4,981	5,054	5,017
ID Total Air Flow-CFM	5,171	5,134	5,208	5,172
Total Watts	15,290	15,200	15,590	15,393
COP	Displays values in heating mode			
EER	10.96	10.72	11.05	10.87

TEMPERATURES AND PRESSURES

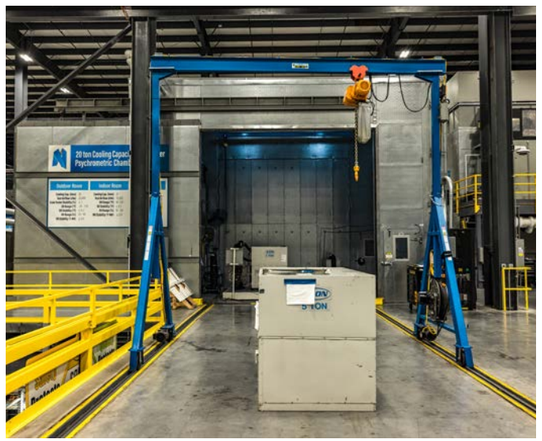
	POINT	MIN	MAX	AVG
ID Return DB	80.0	79.9	80.1	80.0
ID Return WB	66.9	66.8	67.1	66.9
ID Supply DB	58.3	582.0	58.4	58.3
ID Supply WB	56.7	56.6	56.9	56.7
OD Return DB	94.9	94.7	95.1	95.0
OD Return WB	73.7	73.6	73.9	73.8
ID Nozzle DB	58.9	58.9	59.1	58.9
Barometer	981.91	980.76	983.00	981.67
ID Nozzle DP	3.02	2.96	3.05	3.01
ID Before Nozzle	-0.70	-0.87	-0.65	-0.75
OD Nozzle DP	0.32	0.31	0.34	0.32
OD Before Nozzle	-0.01	-0.03	0.01	-0.01
TU Static Pressure	0.35	0.31	0.41	0.36

REFRIGERATION SYSTEM #1 SUMMARY

	POINT	MIN	MAX	AVG
Discharge Pressure (psig)	394.1	389.8	405.8	399.2
Discharge Temp (°F)	161.5	161.1	163.8	162.6
Discharge Sat. Temp (°F)	115.6	114.8	117.8	116.6
Discharge Superheat (°F)	45.9	45.2	46.9	46.0
Suction Pressure (psig)	136.1	135.0	137.3	136.2
Suction Temp (°F)	57.6	57.4	58.1	57.7
Suction Sat. Temp (°F)	47.5	47.0	47.9	47.5
Suction Superheat (°F)	10.2	9.6	10.8	10.2
Liquid Pressure (psig)	375.1	370.6	385.7	379.9
Liquid Temp (°F)	102.5	102.1	104.0	103.2
Liquid Sat. Temp (°F)	112.0	111.1	114.0	112.9
Liquid Subcooling (°F)	9.5	8.7	10.5	9.6

REFRIGERATION SYSTEM #2 SUMMARY

	POINT	MIN	MAX	AVG
Discharge Pressure (psig)	385.7	382.3	395.0	388.6
Discharge Ternp (°F)	160.4	160.0	162.1	161.1
Discharge Sat. Temp (°F)	114.0	113.4	115.8	114.6
Discharge Superheat (°F)	46.4	45.7	47.8	46.6
Suction Pressure (psig)	139.2	138.0	140.7	139.4
Suction Temp (°F)	56.1	54.6	56.8	55.6
Suction Sat. Temp (°F)	48.6	48.2	49.2	48.7
Suction Superheat (°F)	7.5	5.7	8.4	6.9
Liquid Pressure (psig)	367.3	364.8	377.8	371.0
Liquid Temp (°F)	99.7	99.7	101.3	100.5
Liquid Sat. Temp (°F)	110.5	110.0	112.5	111.2
Liquid Subcooling (°F)	10.8	9.7	11.6	10.7



20 Ton Chambers

The North and South 20 ton chambers can each be split in half to provide four 10 ton chambers. The two South 10 ton chambers are unique in allowing for chilled water supply capability for water-source heat pump testing in either the upper or lower chambers. The water loop includes a 15% methynol mixture, which allows for the capability of performing below freezing entering water temperature conditions to the unit.

20 TON COOLING CAPACITY OVER/UNDER PSYCHROMETRIC CHAMBER— NORTH

INDOOR ROOM	Cooling Cap. (tons)	20
	Test Airflow (cfm)	10,000
	DB Range (°F)	40–130
	DB Stability (°F)	± 0.2 °F DB
	RH Range (%)	10–80
	RH Stability	± 0.9 °F WB
OUTDOOR ROOM	Cooling Cap. (tons)	26
	Test Airflow (cfm)	20,000
	Code Tester Stability (%)	± 1
	DB Range (°F)	-20–130
	DB Stability (°F)	± 0.2
	RH Range (%)	10–90
	RH Stability	± 0.9 °F WB
POWER	230V 3Ph Max Amps	470
	460V 3Ph Max Amps	235

Indoor/Outdoor chambers may be used as two separate 10 ton testing chambers

20 TON COOLING CAPACITY OVER/UNDER PSYCHROMETRIC CHAMBER— SOUTH

INDOOR ROOM	Cooling Cap. (tons)	20
	Test Airflow (cfm)	10,000
	DB Range (°F)	40–130
	DB Stability (°F)	± 0.2 °F DB
	RH Range (%)	10–80
	RH Stability	± 0.9 °F WB
OUTDOOR ROOM	Cooling Cap. (tons)	26
	Test Airflow (cfm)	20,000
	Code Tester Stability (%)	± 1
	DB Range (°F)	-20–130
	DB Stability (°F)	± 0.2
	RH Range (%)	10–90
	RH Stability	± 0.9 °F WB
POWER	230V 3Ph Max Amps	470
	460V 3Ph Max Amps	235
CHILLED WATER (15% METHYNOL)	GPM	80
	Capacity (tons)	20
	Temp Range (°F)	14–105

Indoor/Outdoor chambers may be used as two separate 10 ton testing chambers

50 ton rooftop unit in the test chamber

50 and 100 Ton Chambers

The 50 and 100 ton chambers are used for testing larger units. Most testing facilities only have the ability to test up to 60 tons. ASHRAE certification tests up to 63.5 tons. This lab is one of the few that has the capability to test units up to 100 tons.

50 TON COOLING CAPACITY OVER/UNDER PSYCHROMETRIC CHAMBER

INDOOR ROOM	Cooling Cap. (tons)	50
	Test Airflow (cfm)	25,000
	DB Range (°F)	40–130
	DB Stability (°F)	± 0.2 °F DB
	RH Range (%)	10–80
	RH Stability	± 0.9 °F WB
OUTDOOR ROOM	Cooling Cap. (tons)	65
	Test Airflow (cfm)	50,000
	Code Tester Stability (%)	± 1
	DB Range (°F)	0-130
	DB Stability (°F)	± 0.2
	RH Range (%)	10–90
	RH Stability	± 0.9 °F WB
POWER	230V 3Ph Max Amps	627
	460V 3Ph Max Amps	300

100 TON COOLING CAPACITY OVER/UNDER PSYCHROMETRIC CHAMBER

INDOOR ROOM	Cooling Cap. (tons)	100
	Test Airflow (cfm)	50,000
	DB Range (°F)	40-130
	DB Stability (°F)	± 0.2 °F DB
	RH Range (%)	10–80
	RH Stability	± 0.9 °F WB
OUTDOOR ROOM	Cooling Cap. (tons)	130
	Test Airflow (cfm)	100,000
	Code Tester Stability (%)	± 1
	DB Range (°F)	-20–130
	DB Stability (°F)	± 0.2
	RH Range (%)	10–90
	RH Stability	± 0.9 °F WB
POWER	230V 3Ph Max Amps	783
	460V 3Ph Max Amps	391

Additional Psychrometric Chambers

Two additional chambers to the NAIC are the Alpha and Bravo chambers. These chambers are A2L certified and are in a side-by-side layout. A2L is the rating for slightly flammable refrigerant. These chambers have specific sensors to alert the operator if there is a leak in the unit or if a fire is present. These chambers are used for water-source heat pump testing and can also be used for testing split systems. The two units can by piped together through a pass-through hole in between the chambers. A third single water-source heat pump chamber is also available for testing in the building section across from the lab as well as a chamber that can be used for gas heat testing.

WATER-SOURCE HEAT PUMP PSYCHROMETRIC CHAMBER		
INDOOR ROOM	Capacity (tons)	12
	Test Airflow (cfm)	6,000
	DB Range (°F)	40–120
	DB Stability (°F)	± 0.2 °F DB
	RH Range (%)	30–80
	RH Stability	± 0.9 °F WB
POWER	230V 3Ph Max Amps	200
	460V 3Ph Max Amps	200
CHILLED WATER	GPM	50
	Capacity (tons)	12
	Temp. Range (°F)	35–120

Larger Psychrometric Chambers will be used to test water-source heat pump units larger than 12 tons.

15 TON SIDE-BY-SIDE PSYCHROMETRIC CHAMBERS		
ALPHA AND BRAVO CHAMBERS	Capacity (tons)	15
	Test Airflow (cfm)	5,770
	DB Range (°F)	40–120
	DB Stability (°F)	± 0.2 °F DB
	RH Range (%)	30–80
	RH Stability	± 0.9 °F WB
POWER	230V 3Ph Max Amps	200
	460V 3Ph Max Amps	200
CHILLED WATER (15% METHYNOL)	GPM	60
	Capacity (tons)	15
	Temp. Range (°F)	14–105

Larger Psychrometric Chambers will be used to test water-source heat pump units larger than 15 tons.

Alpha and Bravo WSHP chambers

AFUE AND LOW TEMPERATURE TEST CHAMBER		
CHAMBER SIZE	18 ft x 18 ft x 14 ft high	
OUTSIDE TEMPERATURE TEST RANGE	-20 °F to 130 °F (± 1°F)	
HUMIDITY RANGE	30 to 80% (± 1%)	
MAX NG OR LPG CAPACITY	300,000 Btu/hr	
AFUE TEST STANDARD	ANSI 103–2007 Capable	
POWER	230V 3Ph Max Amps	200
	460V 3Ph Max Amps	200

Environmental Chamber

The environmental chamber is one of the greatest marvels of the lab. This chamber has the ability to produce rain, sleet, snow, and wind gusts up to 50 mph! This chamber is the tallest in the lab and was built this way so that rain and snow would fall from above under the force of gravity, rather than being blown out from the side onto the unit. Allowing gravity to take over simulates a more realistic effect of weather conditions falling on the unit.

ENVIRONMENTAL APPLICATION TEST CHAMBER		
CHAMBER SIZE	40 ft x 60 ft x 35 ft high	
OUTSIDE TEMPERATURE TEST RANGE	-20 °F to 130 °F (± 1°F)	
HUMIDITY RANGE	30 to 80% (± 1%)	
MAX NG OR LPG CAPACITY	4 million Btu/hr	
AFUE TEST STANDARD	ANSI 103–2007 Capable	
RAIN TESTING CAPABILITY	8"/per Hour Max	
SNOW TESTING CAPABILITY	2"/per Hour Max	
WIND TESTING CAPABILITY	50 mph Max	
POWER	230V 3Ph Max Amps	783
	460V 3Ph Max Amps	391

Snow in the environmental chamber

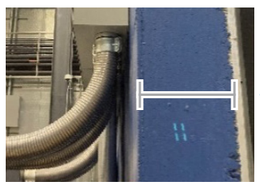
Rain simulation on a rooftop unit

540 Ton Sound and Psychrometric Chamber

Sound and airflow testing, with optional simultaneous performance testing, is available in the 540 ton test chamber. The chamber itself was built first and then the lab was built around it. With this separation, the sound chamber is completely isolated from any noise or vibration within the lab. The 12 inch thick concrete walls isolate this chamber preventing outside noise and vibration from interfering with the testing. Installation of units into the three-room sound and performance chamber includes ducting through the floor of the outdoor room into the supply and return rooms with necessary sealing to prevent air leakage. During the tests, airflow will be measured between the supply room and return room. Return, supply, and radiated sound will be measured simultaneously. Sound power measurements are presented in both ⅓ octaves and full octaves.

SOUND TESTING

CHAMBER DESCRIPTION	3 Chamber Configuration - Outside, Return and Supply
EQUIPMENT	> Brüel & Kjær Pulse LAN-XI Type I Sound Measurement System > Capable of Measuring 10 Channels of Sound or Vibration Simultaneously > Real Time measurement of 1/24 through 1/1 octave bands > Narrow Band FFT Measurements > Simultaneous testing for inlet, outlet and radiated sound with equipment under cooling or heating load
AHU AND PACKAGED UNIT COOLING LOAD	Up to 100,000 cfm and/or 300 tons
CHILLER SOUND POWER TESTING	Up to 540 tons
PURE TONE QUALIFIED	45 Hz through 2,760 Hz
TEST STANDARDS	> Reference Sound Sources Comply with the requirements of ANSI S12.5 > Satisfy the Acoustical Requirements Specified in AMCA 300, ANSI S12.51 (ISO 3741), AHRI 260, and AHRI 220
OUTDOOR ROOM VOLUME	106,326 cubic feet
SUPPLY AND RETURN ROOM VOLUME	51,765 cubic feet each



12 inch thick concrete walls separate the sound chamber from the lab. The flex conduit for wiring absorbs vibrations from the lab to the chamber. This allows the chamber to accurately measure true unit sound.

540 TON CHILLER CAPACITY /300 TON COOLING CAPACITY OVER/UNDER SOUND AND PSYCHROMETRIC CHAMBER

INDOOR ROOM	Cooling Cap. (tons)	300
	Test Airflow (cfm)	100,000
	DB Range (°F)	50–100
	DB Stability (°F)	± 0.2 °F DB
	RH Range (%)	10–80
	RH Stability	± 1 %
OUTDOOR ROOM	Cooling Cap. (tons)	540
	Test Airflow (cfm)	480,000
	Code Tester Stability (%)	± 1
	DB Range (°F)	50–130
	DB Stability (°F)	± 1
	RH Range (%)	10–90
	RH Stability	± 1%
POWER	230V 3Ph Max Amps	1,200
	460V 3Ph Max Amps	800
CHILLED WATER	GPM	1,300
	Capacity (tons)	540
	Temp. Range (°F)	45–65
GAS HEATING CAPACITY	Max Capacity (Btu)	8 million

540 ton sound testing chamber

Open Floor and Safety Testing

The NAIC is not just for refrigeration testing, but also gas heat and electric heat testing as well. These tests may involve specific safety standard testing, component limit testing, lifecycle and corrosion testing, or new product development complying with standards such as UL-60335 and ANSI Z21.47. Units can be tested in one of the floor bays or on the third floor. The third floor provides curbs for over/under configurations, with the unit sitting on the curb and allowing air to be supplied and returned from below. Multiple natural gas and propane gas connections are provided in these testing areas. Instruments for this testing include an NG or LPG gas calorimeter, gas combustion meters, and portable, multi-channel data acquisition devices (DAQ) for reading pressures and temperatures.

SAFETY LIMIT TESTING

This testing is done to ensure that all the safety devices, such as BUPs, limit switches, and high temp switches, activate to prevent the unit from getting too hot. Tests include blocked outlet, blocked inlet, and fan failure. Blocked inlet and outlet simulates if an obstruction was to occur in the ductwork, such as debris or if the damper assembly has failed. Fan failure testing is conducted to ensure that if the fan was to stop running, the limits would still trip the unit and turn off the heat devices, whether a gas heat exchanger or electric heat strips.

LIFECYCLE AND CORROSION TESTING

Lifecycle and corrosion testing pushes the boundaries of how long the safety components can function under a variety of conditions before they fail. Testing may involve high temperature cabinet conditions, warmer or cooler outdoor air conditions. This testing helps to provide accurate heater warranties.

DEVELOPMENT TESTING

Development testing involves pushing the boundaries of innovation with new ideas regarding cabinet design, heat exchanger design, and electric heat testing. An example of this new development is the new gas heat exchanger manifold design that utilizes a single piping connection to the gas valves.

Air handling unit undergoing electric heat testing

OPEN TESTING AREA (25,000 FT²)

AREA	SIZE	DESCRIPTION	MAX CEILING HEIGHT	MAX SINGLE UNIT TEST WIDTH	MAX SINGLE UNIT TEST LENGTH
Over/Under Rooftop Unit Testing Area	150 ft x 50 ft with 12 ft x 30 ft Floor Openings	> Up to 150 ton Capacity > Ducts Through Floor–Bottom Discharge and Return > Outside air duct connection available for exhaust and makeup air > Four Testing Areas	30 feet	12 feet	30 feet
Open Testing Area (Ground Floor)	320 ft x 80 ft	> Flexible Connections > 24 Gas Testing Stations > 36 million Btu/hr of natural gas service > 1,200 Amps of electrical service > Building Mock Up Testing	55 feet	18 feet	100 feet

Heating test area

TEST GASES AND CAPACITIES

NATURAL GAS	Maximum Test Area Total Capacity—60 million Btu/hr
	5–10,000 ft³/hr connections
	11–4,000 ft³/hr connections
LP GAS	Maximum Test Area Total Capacity—10 million Btu/hr
	1–10,000 ft³/hr connection
	7–4,000 ft³/hr connections
BUTANE/AIR MIXED GAS	600 ft³/hr

DIRECT FIRED TESTING CAPABILITIES

NATURAL GAS	20 million Btu/hr Max
LIQUID PROPANE GAS	10 million Btu/hr Max
NON-RECIRCULATING AND RECIRCULATING	ANSI Z83.4–2015 and Z83.18–2015
COMBUSTION INSTRUMENTATION PER ANSI STANDARDS	300,000 Btu/hr
MAXIMUM TEST LENGTH	300 ft straight (longer with offset)

AIRFLOW TESTING

4 ROLL AROUND AIRFLOW TEST TUNNELS	Up to 15,000 cfm

Chamber Water Supply Pumping Package

The driving force behind the ability to perform testing in the chambers is all due to the chilled water pumping package. The lab was built to supply chilled water to all the chamber skids as well as to the water loops for water-source heat pump testing. Each chamber is built with its own water loop on a separate pump, so if one pump stops functioning, it can be closed off while the other chambers remain in operation. The water is supplied by a 540 ton chiller with Turbocor compressors and a 420 ton chiller utilizing tandem scroll compressors. This pumping package is the heart of what keeps the chambers in operation. The hot water for the chambers is supplied by two high efficiency boilers. These boilers have variable capacity control to keep up with the load needed for the hot water coils of the chambers.

Building Facts

BASIC BUILDING INFORMATION

LOCATION	AAON Headquarters—Tulsa, OK
HEIGHT	Three Stories—65 ft Tall
FOOTPRINT	75,000 ft²— 327 ft (North & South) x 230 ft (East & West)
FACILITY CHILLED WATER CAPACITY	960 tons
FACILITY ELECTRICAL CAPACITY	7.25 Megawatts

EMPLOYEES

70 TOTAL EMPLOYEES	30 Engineers
	30 Chamber Operators
	10 Facilities Personnel

OPERATING HOURS

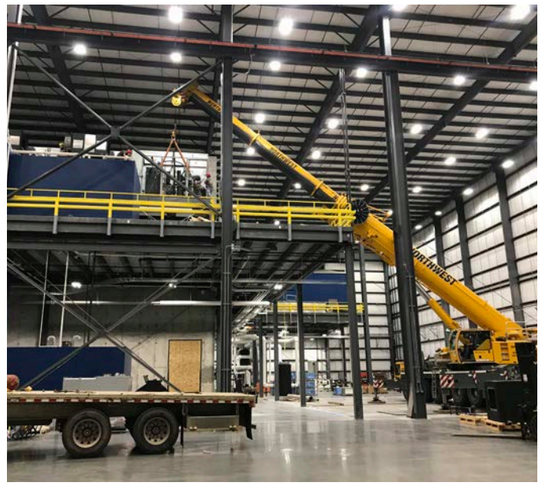
12 Hours/Day and 7 Days/Week

ELECTRICAL CAPABILITIES

0-480V/3Ø VARIABLE (PHASE BALANCE)	900 amps Max	Multiple Power Connections
480V/3Ø NON-VARIABLE VOLTAGE	1200 amps Max	Multiple Power Connections

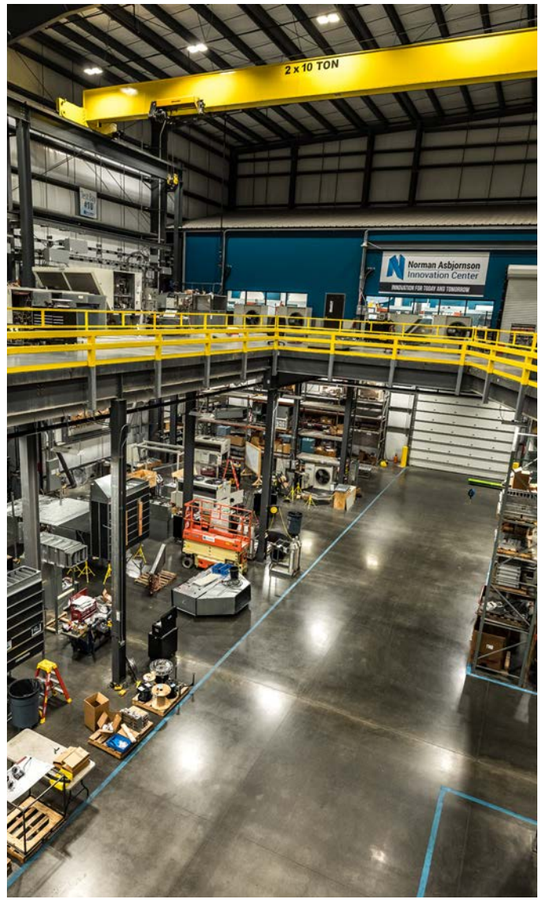
MATERIALS USED IN CONSTRUCTION

REINFORCING STEEL	278 tons (556,000 lbs.)
STRUCTURAL STEEL	1,224 tons
CONCRETE	6,520 cubic yards
IMPORTED SELECT FILL FOR BUILDING PAD	8,000 cubic yards
IMPORTED ROCK BASE UNDER 1ST FLOOR	5,600 tons



Cooling and Heating Standards

COOLING TEST STANDARDS	
AHRI 210/240	Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment
AHRI 340/360	Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
ASHRAE 37	Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment
ISO 13256	Water-Source Heat Pumps Testing and Rating for Performance: Water-to-Water and Brine-to-Water Heat Pumps
ASHRAE 198	Method of Test for Rating DX-Dedicated Outdoor Air Systems for Moisture Removal Capacity and Moisture Removal Efficiency
AHRI 410	Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI 870	Performance Rating of Direct Geoexchange Heat Pumps
AHRI 390	Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps
AHRI 365	Commercial and Industrial Unitary Air-Conditioning Condensing Units
AHRI 550/590	Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle
AHRI 920	DX Dedicated Outdoor Air System Units



HEATING TEST STANDARDS CAPABILITIES	
ANSI 103-2007	Method of Testing Annual Fuel Utilization Efficiency
ANSI Z21.47-2016	Gas Fired Central Furnaces
ANSI Z83.8-2016	Gas Unit Heaters, Gas Packaged Heaters, etc.
ANSI Z83.4-2015	Non-Recirculating Direct Fired Gas Heaters
ANSI Z83.18-2015	Recirculating Direct Fired Gas Heaters
UL 60335-1 UL 60335-2-40	Standard for Safety—Heating and Cooling Equipment

The NAIC sets the stage for cutting-edge performance testing of HVAC equipment by offering a comprehensive array of 12 calibrated testing chambers. These state-of-the-art chambers ensure unparalleled testing accuracy, aligning with industry standards set by AHRI and ASHRAE. With a lab facility equipped with multiple chambers, development testing can be conducted throughout the year, following a consistent schedule. Beyond its research and development capabilities, the lab provides a captivating and immersive experience for customers, allowing them to witness their units' real-world performance firsthand or during visits.

Schedule testing or a lab tour by contacting your local AAON representative: aaon.com/find-a-rep.

Scheduling of witness testing is subject to the lab test chamber availability and is independent of the AAON production schedule. The dates for testing units can be scheduled after an order is entered.

Experience the NAIC in person.

Contact your local rep to schedule testing or a lab tour.

Norman Asbjornson Innovation Center